Full wwPDB X-ray Structure Validation Report (i)

Mar 4, 2026 – 10:52 PM UTC

PDB ID	:	6CHH / pdb_00006chh
Title	:	Structure of human NNMT in complex with bisubstrate inhibitor MS2756
Authors	:	Babault, N.; Liu, J.; Jin, J.
Deposited on	:	2018-02-22
Resolution	:	2.30 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

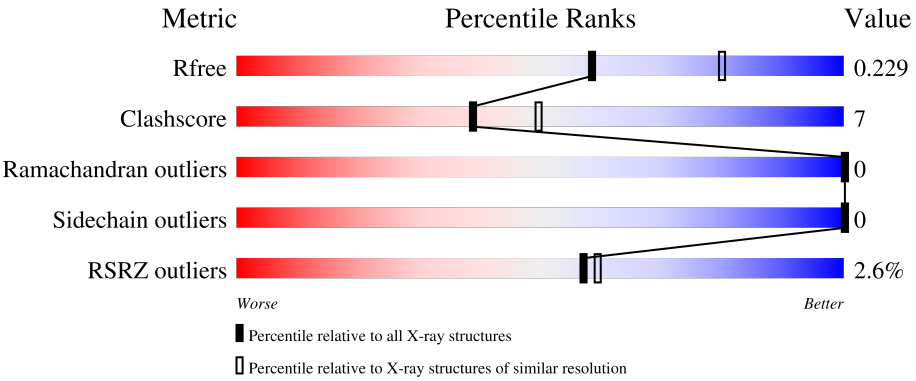
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	283	3% 79% 16% 5%
1	B	283	2% 84% 10% 6%
1	C	283	2% 72% 14% 14%
1	D	283	2% 71% 15% 14%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 8357 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Nicotinamide N-methyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	269	Total	C	N	O	S	0	0	0
			2095	1339	345	399	12			
1	B	267	Total	C	N	O	S	0	0	0
			2078	1330	340	396	12			
1	C	244	Total	C	N	O	S	0	0	0
			1901	1222	308	360	11			
1	D	243	Total	C	N	O	S	0	0	0
			1897	1217	310	359	11			

There are 88 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	MET	-	initiating methionine	UNP P40261
A	-17	GLY	-	expression tag	UNP P40261
A	-16	SER	-	expression tag	UNP P40261
A	-15	SER	-	expression tag	UNP P40261
A	-14	HIS	-	expression tag	UNP P40261
A	-13	HIS	-	expression tag	UNP P40261
A	-12	HIS	-	expression tag	UNP P40261
A	-11	HIS	-	expression tag	UNP P40261
A	-10	HIS	-	expression tag	UNP P40261
A	-9	HIS	-	expression tag	UNP P40261
A	-8	SER	-	expression tag	UNP P40261
A	-7	SER	-	expression tag	UNP P40261
A	-6	GLY	-	expression tag	UNP P40261
A	-5	LEU	-	expression tag	UNP P40261
A	-4	VAL	-	expression tag	UNP P40261
A	-3	PRO	-	expression tag	UNP P40261
A	-2	ARG	-	expression tag	UNP P40261
A	-1	GLY	-	expression tag	UNP P40261
A	0	SER	-	expression tag	UNP P40261
A	100	ALA	LYS	engineered mutation	UNP P40261
A	101	ALA	GLU	engineered mutation	UNP P40261

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Chain	Residue	Modelled	Actual	Comment	Reference
A	103	ALA	GLU	engineered mutation	UNP P40261
B	-18	MET	-	initiating methionine	UNP P40261
B	-17	GLY	-	expression tag	UNP P40261
B	-16	SER	-	expression tag	UNP P40261
B	-15	SER	-	expression tag	UNP P40261
B	-14	HIS	-	expression tag	UNP P40261
B	-13	HIS	-	expression tag	UNP P40261
B	-12	HIS	-	expression tag	UNP P40261
B	-11	HIS	-	expression tag	UNP P40261
B	-10	HIS	-	expression tag	UNP P40261
B	-9	HIS	-	expression tag	UNP P40261
B	-8	SER	-	expression tag	UNP P40261
B	-7	SER	-	expression tag	UNP P40261
B	-6	GLY	-	expression tag	UNP P40261
B	-5	LEU	-	expression tag	UNP P40261
B	-4	VAL	-	expression tag	UNP P40261
B	-3	PRO	-	expression tag	UNP P40261
B	-2	ARG	-	expression tag	UNP P40261
B	-1	GLY	-	expression tag	UNP P40261
B	0	SER	-	expression tag	UNP P40261
B	100	ALA	LYS	engineered mutation	UNP P40261
B	101	ALA	GLU	engineered mutation	UNP P40261
B	103	ALA	GLU	engineered mutation	UNP P40261
C	-18	MET	-	initiating methionine	UNP P40261
C	-17	GLY	-	expression tag	UNP P40261
C	-16	SER	-	expression tag	UNP P40261
C	-15	SER	-	expression tag	UNP P40261
C	-14	HIS	-	expression tag	UNP P40261
C	-13	HIS	-	expression tag	UNP P40261
C	-12	HIS	-	expression tag	UNP P40261
C	-11	HIS	-	expression tag	UNP P40261
C	-10	HIS	-	expression tag	UNP P40261
C	-9	HIS	-	expression tag	UNP P40261
C	-8	SER	-	expression tag	UNP P40261
C	-7	SER	-	expression tag	UNP P40261
C	-6	GLY	-	expression tag	UNP P40261
C	-5	LEU	-	expression tag	UNP P40261
C	-4	VAL	-	expression tag	UNP P40261
C	-3	PRO	-	expression tag	UNP P40261
C	-2	ARG	-	expression tag	UNP P40261
C	-1	GLY	-	expression tag	UNP P40261
C	0	SER	-	expression tag	UNP P40261

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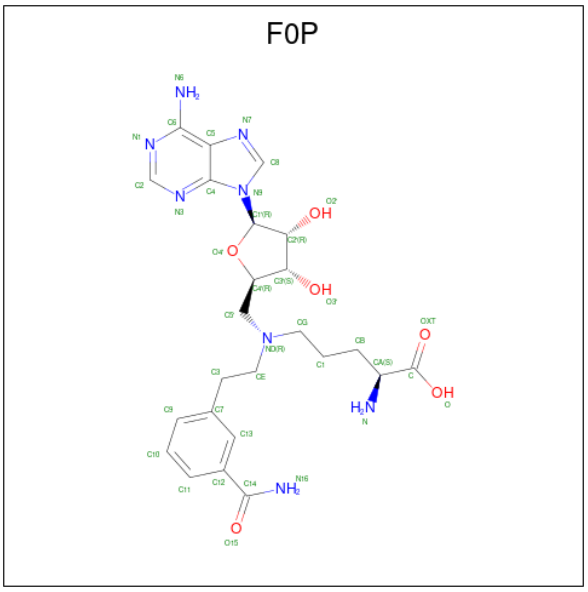
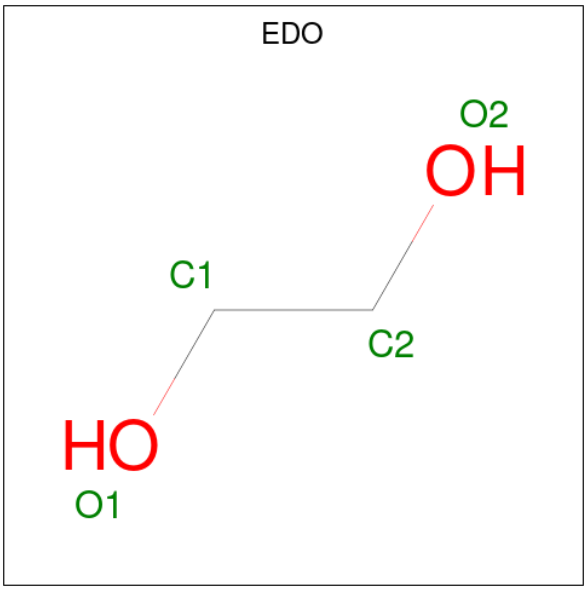
Chain	Residue	Modelled	Actual	Comment	Reference
C	100	ALA	LYS	engineered mutation	UNP P40261
C	101	ALA	GLU	engineered mutation	UNP P40261
C	103	ALA	GLU	engineered mutation	UNP P40261
D	-18	MET	-	initiating methionine	UNP P40261
D	-17	GLY	-	expression tag	UNP P40261
D	-16	SER	-	expression tag	UNP P40261
D	-15	SER	-	expression tag	UNP P40261
D	-14	HIS	-	expression tag	UNP P40261
D	-13	HIS	-	expression tag	UNP P40261
D	-12	HIS	-	expression tag	UNP P40261
D	-11	HIS	-	expression tag	UNP P40261
D	-10	HIS	-	expression tag	UNP P40261
D	-9	HIS	-	expression tag	UNP P40261
D	-8	SER	-	expression tag	UNP P40261
D	-7	SER	-	expression tag	UNP P40261
D	-6	GLY	-	expression tag	UNP P40261
D	-5	LEU	-	expression tag	UNP P40261
D	-4	VAL	-	expression tag	UNP P40261
D	-3	PRO	-	expression tag	UNP P40261
D	-2	ARG	-	expression tag	UNP P40261
D	-1	GLY	-	expression tag	UNP P40261
D	0	SER	-	expression tag	UNP P40261
D	100	ALA	LYS	engineered mutation	UNP P40261
D	101	ALA	GLU	engineered mutation	UNP P40261
D	103	ALA	GLU	engineered mutation	UNP P40261

- Molecule 2 is (2 {S})-5-[2-(3-aminocarbonylphenyl)ethyl-[[(2 {R},3 {S},4 {R},5 {R})-5-(6-aminopurin-9-yl)-3,4-bis(oxidanyl)oxolan-2-yl]methyl]amino]-2-azanyl-pentanoic acid (CCD ID: F0P) (formula: $C_{24}H_{32}N_8O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			38	24	8	6		
2	B	1	Total	C	N	O	0	0
			38	24	8	6		
2	C	1	Total	C	N	O	0	0
			38	24	8	6		
2	D	1	Total	C	N	O	0	0
			38	24	8	6		

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0

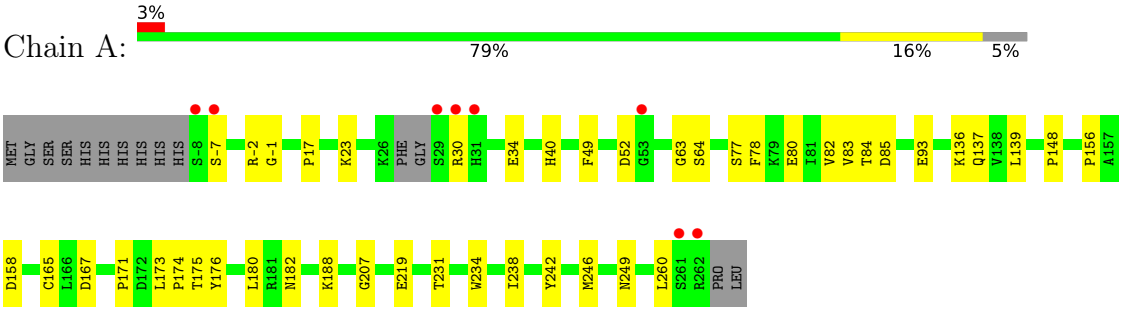
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	72	Total O 72 72	0	0
4	B	65	Total O 65 65	0	0
4	C	46	Total O 46 46	0	0
4	D	43	Total O 43 43	0	0

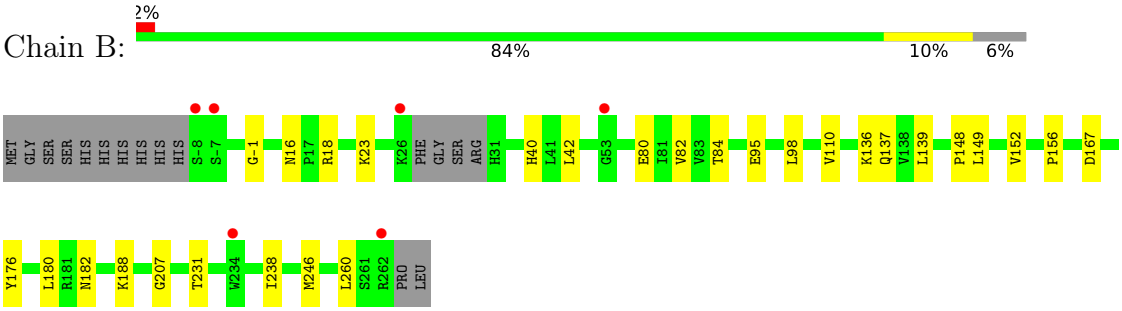
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

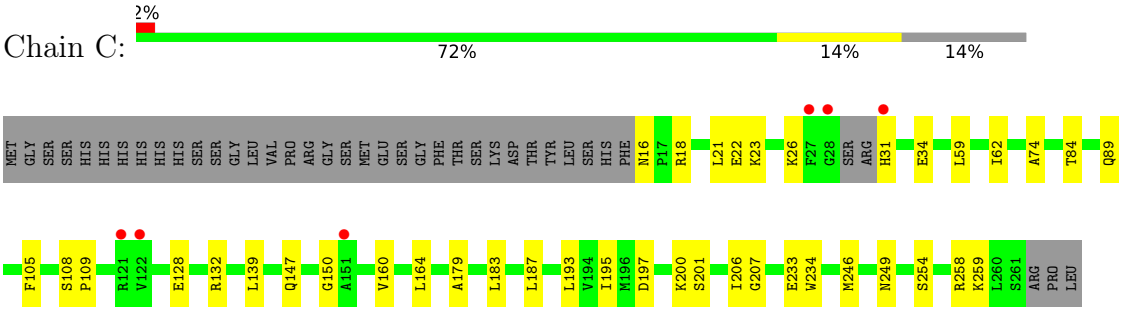
• Molecule 1: Nicotinamide N-methyltransferase



• Molecule 1: Nicotinamide N-methyltransferase

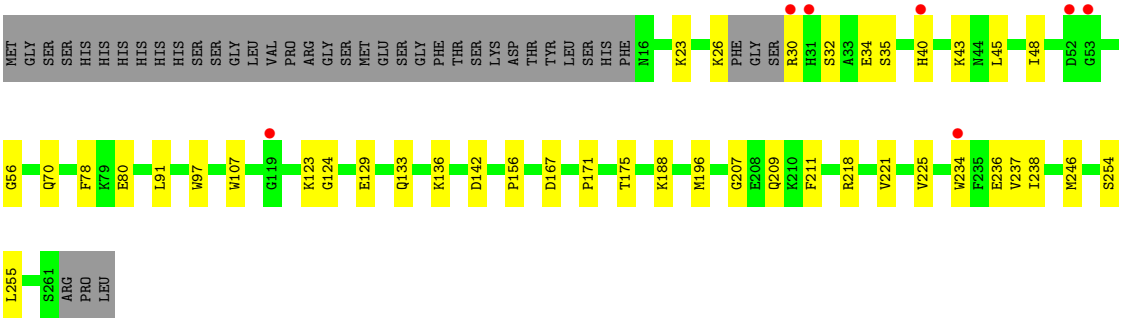


• Molecule 1: Nicotinamide N-methyltransferase



• Molecule 1: Nicotinamide N-methyltransferase




MET GLY SER SER HIS HIS HIS HIS HIS HIS SER SER GLY LEU VAL PRO ARG GLY SER MET GLU SER GLY PHE THR SER LYS ASP THR TYR LEU SER HIS PHE N16 K23 K26 PHE GLY SER R30 H31 S32 A33 E34 S35 H40 K43 N44 L45 I48 D52 G53
G56 Q70 F78 K79 E80 L91 W97 W107 G119 K123 G124 E129 Q133 K136 D142 P156 D167 P171 T175 K188 M196 G207 E208 Q209 K210 F211 R218 V221 V225 W234 P235 E236 V237 I238 M246 S254
L255 S261 ARG PRO LEU

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	46.44Å 62.56Å 107.98Å 91.76° 98.05° 111.83°	Depositor
Resolution (Å)	53.24 – 2.30 53.24 – 2.30	Depositor EDS
% Data completeness (in resolution range)	89.1 (53.24-2.30) 89.1 (53.24-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.14	Depositor
$< I/\sigma(I) >$ [1]	3.46 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.168 , 0.229 0.169 , 0.229	Depositor DCC
R_{free} test set	2038 reflections (4.12%)	wwPDB-VP
Wilson B-factor (Å^2)	20.6	Xtriage
Anisotropy	0.821	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 51.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	8357	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.71% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: EDO, F0P

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	A	0.36	0/2138	0.52	0/2892
1	B	0.34	0/2121	0.53	0/2870
1	C	0.33	0/1940	0.52	0/2627
1	D	0.31	0/1935	0.51	0/2620
All	All	0.33	0/8134	0.52	0/11009

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2095	0	2108	34	0
1	B	2078	0	2090	21	0
1	C	1901	0	1916	27	0
1	D	1897	0	1917	32	0
2	A	38	0	0	1	0
2	B	38	0	0	0	0
2	C	38	0	0	0	0
2	D	38	0	0	1	0
3	B	8	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	72	0	0	2	0
4	B	65	0	0	1	0
4	C	46	0	0	2	0
4	D	43	0	0	1	0
All	All	8357	0	8043	110	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

All (110) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:179:ALA:O	1:C:183:LEU:HD12	1.74	0.88
1:A:23:LYS:HE3	1:A:246:MET:HG2	1.59	0.82
1:A:231:THR:HB	1:A:260:LEU:HD21	1.69	0.74
1:A:173:LEU:HG	1:A:174:PRO:HD3	1.69	0.73
1:C:23:LYS:HE2	1:C:207:GLY:H	1.53	0.71
1:B:16:ASN:OD1	1:B:18:ARG:HG2	1.93	0.69
1:A:80:GLU:HG2	1:A:136:LYS:HZ2	1.58	0.68
1:A:23:LYS:HE2	1:A:207:GLY:H	1.60	0.67
1:D:23:LYS:HE3	1:D:207:GLY:H	1.60	0.67
1:D:34:GLU:HG2	1:D:246:MET:HE2	1.79	0.65
1:B:82:VAL:HG22	1:B:137:GLN:HB2	1.79	0.63
1:A:219:GLU:H	1:A:219:GLU:CD	2.06	0.63
1:B:149:LEU:O	1:B:152:VAL:HG12	1.99	0.63
1:C:16:ASN:N	4:C:402:HOH:O	2.31	0.63
1:C:187:LEU:HB3	1:C:259:LYS:HD2	1.80	0.61
1:B:231:THR:HB	1:B:260:LEU:HD21	1.83	0.61
1:A:171:PRO:HD2	1:A:175:THR:HG21	1.82	0.60
1:B:148:PRO:HG3	1:B:182:ASN:HB3	1.83	0.59
1:A:52:ASP:OD1	1:D:43:LYS:NZ	2.25	0.58
1:A:-2:ARG:CZ	1:A:-1:GLY:H	2.17	0.58
1:B:40:HIS:CD2	1:B:238:ILE:HD13	2.39	0.57
1:A:23:LYS:CE	1:A:207:GLY:H	2.18	0.57
1:A:34:GLU:HG2	1:A:246:MET:HE1	1.88	0.56
1:C:18:ARG:O	1:C:22:GLU:HG3	2.06	0.56
1:A:148:PRO:HG3	1:A:182:ASN:HB3	1.87	0.55
1:A:30:ARG:NE	1:A:30:ARG:HA	2.21	0.55
1:B:42:LEU:HD11	1:B:110:VAL:HG13	1.88	0.55
1:A:64:SER:OG	1:A:83:VAL:HG13	2.06	0.55
1:A:234:TRP:HE1	1:D:236:GLU:CD	2.16	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:200:LYS:NZ	4:C:404:HOH:O	2.35	0.54
1:C:22:GLU:O	1:C:26:LYS:HB2	2.08	0.54
1:D:34:GLU:CG	1:D:246:MET:HE2	2.40	0.52
1:D:80:GLU:HG2	1:D:136:LYS:HD2	1.91	0.52
1:A:-2:ARG:NH1	4:A:403:HOH:O	2.43	0.51
1:B:40:HIS:CE1	1:B:238:ILE:HG21	2.46	0.51
1:D:26:LYS:O	1:D:30:ARG:NH1	2.43	0.51
1:C:23:LYS:HE2	1:C:206:ILE:HA	1.92	0.50
1:C:160:VAL:HG23	1:C:187:LEU:HD13	1.92	0.50
1:B:23:LYS:HE3	1:B:246:MET:SD	2.52	0.50
1:D:209:GLN:HG2	1:D:211:PHE:CZ	2.47	0.50
1:A:40:HIS:CE1	1:A:238:ILE:HD13	2.47	0.50
1:D:167:ASP:HB2	4:D:411:HOH:O	2.11	0.50
1:A:-7:SER:OG	1:B:98:LEU:HD23	2.12	0.49
1:C:147:GLN:NE2	1:C:150:GLY:O	2.45	0.49
1:C:89:GLN:H	1:C:89:GLN:CD	2.21	0.49
1:D:40:HIS:CE1	1:D:238:ILE:HG21	2.48	0.49
1:D:23:LYS:CE	1:D:207:GLY:H	2.25	0.48
1:D:123:LYS:HG3	1:D:124:GLY:N	2.29	0.48
1:A:167:ASP:HB2	4:A:438:HOH:O	2.15	0.47
1:B:23:LYS:HG3	1:B:246:MET:HE1	1.96	0.47
1:D:123:LYS:HG3	1:D:124:GLY:H	1.80	0.47
1:B:156:PRO:HB2	1:B:188:LYS:HG3	1.98	0.46
1:A:242:TYR:H	1:A:249:ASN:HD21	1.64	0.46
1:B:167:ASP:HB2	4:B:414:HOH:O	2.15	0.46
1:A:17:PRO:HB2	1:A:93:GLU:HG3	1.98	0.46
1:D:32:SER:H	1:D:35:SER:HB3	1.81	0.46
1:D:56:GLY:O	1:D:78:PHE:HA	2.16	0.46
1:B:23:LYS:HD3	1:B:207:GLY:H	1.81	0.46
1:D:40:HIS:HE1	1:D:236:GLU:OE1	1.99	0.45
1:B:84:THR:HA	1:B:139:LEU:O	2.16	0.45
1:D:218:ARG:NH1	1:D:237:VAL:HG21	2.30	0.45
1:C:164:LEU:HD23	1:C:197:ASP:HA	1.99	0.45
1:A:156:PRO:HB2	1:A:188:LYS:HG2	1.98	0.45
1:C:201:SER:HB2	1:C:249:ASN:HB3	1.99	0.45
1:A:80:GLU:HG2	1:A:136:LYS:NZ	2.30	0.45
1:C:23:LYS:CE	1:C:207:GLY:H	2.25	0.45
1:D:45:LEU:HD13	1:D:70:GLN:HA	1.98	0.45
1:A:82:VAL:HG22	1:A:137:GLN:HB2	1.99	0.44
1:B:80:GLU:HG2	1:B:136:LYS:HE3	1.99	0.44
1:A:84:THR:HA	1:A:139:LEU:O	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:34:GLU:HG2	1:C:246:MET:HE1	1.99	0.44
1:D:129:GLU:O	1:D:133:GLN:HG2	2.18	0.44
1:D:171:PRO:HD2	1:D:175:THR:HG21	2.00	0.44
1:A:176:TYR:CE1	1:A:180:LEU:HD11	2.52	0.44
1:A:63:GLY:HA3	1:A:165:CYS:SG	2.58	0.43
1:D:26:LYS:C	1:D:30:ARG:HH11	2.26	0.43
1:A:85:ASP:OD2	2:A:301:F0P:O2'	2.37	0.43
1:D:142:ASP:HA	2:D:301:F0P:N1	2.33	0.43
1:C:234:TRP:CH2	1:C:254:SER:HB2	2.54	0.43
1:D:23:LYS:HG2	1:D:246:MET:HE1	2.00	0.42
1:D:91:LEU:HD23	1:D:91:LEU:HA	1.85	0.42
1:D:221:VAL:O	1:D:225:VAL:HG23	2.18	0.42
1:A:49:PHE:O	1:A:77:SER:OG	2.37	0.42
1:A:176:TYR:HE1	1:A:180:LEU:HD11	1.84	0.42
1:C:164:LEU:HA	1:C:197:ASP:OD1	2.19	0.42
1:D:246:MET:HB3	1:D:246:MET:HE3	1.87	0.42
1:D:48:ILE:HG12	1:D:234:TRP:HZ2	1.83	0.42
1:B:-1:GLY:HA2	3:B:302:EDO:H22	2.00	0.42
1:C:193:LEU:HD21	1:C:195:ILE:HD11	2.00	0.42
1:A:-7:SER:HB3	1:B:95:GLU:HB3	2.02	0.42
1:B:176:TYR:CE1	1:B:180:LEU:HD11	2.54	0.42
1:D:156:PRO:HB2	1:D:188:LYS:HG3	2.02	0.42
1:C:21:LEU:HB3	1:C:105:PHE:CE1	2.55	0.42
1:C:59:LEU:CD2	1:C:74:ALA:HB1	2.50	0.42
1:C:258:ARG:HA	1:C:258:ARG:HD2	1.92	0.41
1:D:40:HIS:CD2	1:D:238:ILE:HD13	2.55	0.41
1:C:128:GLU:O	1:C:132:ARG:HG3	2.21	0.41
1:C:62:ILE:HG21	1:C:183:LEU:HD21	2.01	0.41
1:D:196:MET:HE3	1:D:254:SER:OG	2.21	0.41
1:A:23:LYS:CE	1:A:246:MET:HG2	2.42	0.41
1:B:139:LEU:HD13	1:B:152:VAL:HG11	2.02	0.41
1:C:233:GLU:OE1	1:C:258:ARG:NH1	2.46	0.41
1:C:31:HIS:ND1	1:C:31:HIS:N	2.69	0.41
1:C:108:SER:N	1:C:109:PRO:HD2	2.36	0.40
1:D:97:TRP:CD1	1:D:107:TRP:HD1	2.39	0.40
1:B:16:ASN:OD1	1:B:18:ARG:NH1	2.53	0.40
1:A:231:THR:HB	1:A:260:LEU:CD2	2.46	0.40
1:C:84:THR:HA	1:C:139:LEU:O	2.22	0.40
1:D:255:LEU:C	1:D:255:LEU:HD12	2.45	0.40
1:A:78:PHE:HE1	1:A:158:ASP:HB2	1.87	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	265/283 (94%)	258 (97%)	7 (3%)	0	100	100
1	B	263/283 (93%)	256 (97%)	7 (3%)	0	100	100
1	C	240/283 (85%)	235 (98%)	5 (2%)	0	100	100
1	D	239/283 (84%)	235 (98%)	4 (2%)	0	100	100
All	All	1007/1132 (89%)	984 (98%)	23 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	233/245 (95%)	233 (100%)	0	100	100
1	B	231/245 (94%)	231 (100%)	0	100	100
1	C	210/245 (86%)	210 (100%)	0	100	100
1	D	210/245 (86%)	210 (100%)	0	100	100
All	All	884/980 (90%)	884 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	92	GLN
1	A	137	GLN
1	A	209	GLN
1	B	31	HIS
1	B	90	ASN
1	C	89	GLN
1	D	40	HIS
1	D	137	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

6 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	F0P	C	301	-	40,41,41	1.16	3 (7%)	54,58,58	1.99	14 (25%)
2	F0P	A	301	-	40,41,41	1.18	3 (7%)	54,58,58	1.87	13 (24%)
3	EDO	B	301	-	3,3,3	0.49	0	2,2,2	0.30	0
2	F0P	D	301	-	40,41,41	1.11	1 (2%)	54,58,58	1.92	12 (22%)
3	EDO	B	302	-	3,3,3	0.56	0	2,2,2	0.06	0
2	F0P	B	303	-	40,41,41	1.20	4 (10%)	54,58,58	1.85	17 (31%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	F0P	C	301	-	-	5/27/43/43	0/4/4/4
2	F0P	A	301	-	-	11/27/43/43	0/4/4/4
3	EDO	B	301	-	-	1/1/1/1	-
2	F0P	D	301	-	-	7/27/43/43	0/4/4/4
3	EDO	B	302	-	-	0/1/1/1	-
2	F0P	B	303	-	-	5/27/43/43	0/4/4/4

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	303	F0P	C14-N16	5.29	1.42	1.33
2	C	301	F0P	C14-N16	5.09	1.42	1.33
2	D	301	F0P	C14-N16	5.05	1.42	1.33
2	A	301	F0P	C14-N16	5.00	1.42	1.33
2	A	301	F0P	C8-N7	2.36	1.36	1.31
2	C	301	F0P	C8-N9	-2.33	1.33	1.37
2	C	301	F0P	C5-N7	-2.23	1.35	1.39
2	A	301	F0P	C5-N7	-2.14	1.35	1.39
2	B	303	F0P	C5-N7	-2.12	1.35	1.39
2	B	303	F0P	C8-N7	2.08	1.35	1.31
2	B	303	F0P	C4-N9	-2.06	1.33	1.37

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	301	F0P	C5-C4-N3	-6.07	118.36	126.72
2	A	301	F0P	C5-C4-N3	-5.25	119.49	126.72
2	D	301	F0P	C5-C4-N3	-5.16	119.61	126.72
2	A	301	F0P	N3-C2-N1	-4.94	121.10	128.58
2	D	301	F0P	N3-C2-N1	-4.80	121.31	128.58
2	B	303	F0P	C5-C4-N3	-4.62	120.35	126.72
2	D	301	F0P	N9-C8-N7	-4.48	107.58	113.94
2	B	303	F0P	N3-C2-N1	-4.39	121.93	128.58
2	C	301	F0P	N3-C2-N1	-4.15	122.30	128.58
2	C	301	F0P	N9-C8-N7	-4.03	108.22	113.94
2	C	301	F0P	N3-C4-N9	3.94	133.87	127.17
2	D	301	F0P	C4-N9-C8	3.68	109.60	105.74
2	B	303	F0P	N9-C8-N7	-3.67	108.73	113.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	301	F0P	C4-C5-N7	-3.55	106.52	110.58
2	C	301	F0P	C2-N3-C4	3.54	120.47	111.83
2	A	301	F0P	C2-N3-C4	3.50	120.37	111.83
2	D	301	F0P	N3-C4-N9	3.49	133.10	127.17
2	D	301	F0P	C2-N3-C4	3.46	120.28	111.83
2	C	301	F0P	C5-N7-C8	3.42	108.83	103.45
2	A	301	F0P	CE-ND-C5'	-3.35	104.08	111.89
2	A	301	F0P	N9-C8-N7	-3.35	109.19	113.94
2	D	301	F0P	C5-N7-C8	3.33	108.69	103.45
2	D	301	F0P	C4-C5-N7	-3.27	106.84	110.58
2	A	301	F0P	N3-C4-N9	3.24	132.68	127.17
2	B	303	F0P	C12-C14-N16	3.20	121.69	117.74
2	B	303	F0P	C4-C5-N7	-3.16	106.97	110.58
2	B	303	F0P	C2-N3-C4	3.02	119.20	111.83
2	C	301	F0P	CE-ND-C5'	-2.98	104.95	111.89
2	C	301	F0P	C12-C14-N16	2.97	121.39	117.74
2	C	301	F0P	C4-N9-C8	2.79	108.67	105.74
2	B	303	F0P	C5-N7-C8	2.79	107.84	103.45
2	A	301	F0P	C12-C14-N16	2.77	121.15	117.74
2	A	301	F0P	C4-C5-N7	-2.74	107.45	110.58
2	B	303	F0P	CB-C1-CG	-2.74	105.19	113.29
2	D	301	F0P	CE-ND-C5'	-2.61	105.80	111.89
2	B	303	F0P	O4'-C1'-N9	2.61	113.10	108.09
2	B	303	F0P	N3-C4-N9	2.56	131.52	127.17
2	A	301	F0P	C5-N7-C8	2.53	107.43	103.45
2	B	303	F0P	C4-N9-C8	2.47	108.34	105.74
2	D	301	F0P	C1-CB-CA	2.47	121.19	113.22
2	D	301	F0P	CB-C1-CG	-2.44	106.09	113.29
2	A	301	F0P	C1-CB-CA	2.42	121.05	113.22
2	C	301	F0P	C1-CB-CA	2.34	120.77	113.22
2	C	301	F0P	C1-CG-ND	2.33	120.48	113.93
2	B	303	F0P	CE-ND-C5'	-2.26	106.63	111.89
2	C	301	F0P	CB-C1-CG	-2.26	106.62	113.29
2	A	301	F0P	C4-N9-C8	2.26	108.11	105.74
2	B	303	F0P	CG-ND-C5'	2.24	117.12	111.89
2	A	301	F0P	CE-ND-CG	2.20	116.68	111.44
2	D	301	F0P	C3-C7-C13	2.18	124.21	120.54
2	C	301	F0P	O4'-C1'-N9	2.17	112.26	108.09
2	B	303	F0P	C1-CG-ND	2.17	120.03	113.93
2	B	303	F0P	O15-C14-N16	-2.15	119.51	122.62
2	B	303	F0P	O3'-C3'-C4'	-2.15	104.90	111.08
2	B	303	F0P	C5-C4-N9	2.13	108.13	105.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	301	F0P	O-C-OXT	-2.12	119.27	124.08

There are no chirality outliers.

All (29) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	F0P	N-CA-CB-C1
2	A	301	F0P	C-CA-CB-C1
2	A	301	F0P	C4'-C5'-ND-CG
2	A	301	F0P	O4'-C4'-C5'-ND
2	B	303	F0P	C4'-C5'-ND-CG
2	C	301	F0P	C4'-C5'-ND-CG
2	B	303	F0P	C3-CE-ND-CG
2	D	301	F0P	C3-CE-ND-CG
2	A	301	F0P	CB-C1-CG-ND
2	A	301	F0P	CG-C1-CB-CA
2	B	303	F0P	CE-C3-C7-C13
2	B	303	F0P	CE-C3-C7-C9
3	B	301	EDO	O1-C1-C2-O2
2	A	301	F0P	CE-C3-C7-C13
2	D	301	F0P	CE-C3-C7-C13
2	A	301	F0P	CE-C3-C7-C9
2	C	301	F0P	CE-C3-C7-C13
2	D	301	F0P	CE-C3-C7-C9
2	C	301	F0P	CE-C3-C7-C9
2	A	301	F0P	C3'-C4'-C5'-ND
2	D	301	F0P	C4'-C5'-ND-CG
2	A	301	F0P	O-C-CA-CB
2	D	301	F0P	CB-C1-CG-ND
2	C	301	F0P	O-C-CA-CB
2	C	301	F0P	OXT-C-CA-CB
2	D	301	F0P	C4'-C5'-ND-CE
2	A	301	F0P	OXT-C-CA-CB
2	D	301	F0P	OXT-C-CA-CB
2	B	303	F0P	C2'-C1'-N9-C8

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	301	F0P	1	0

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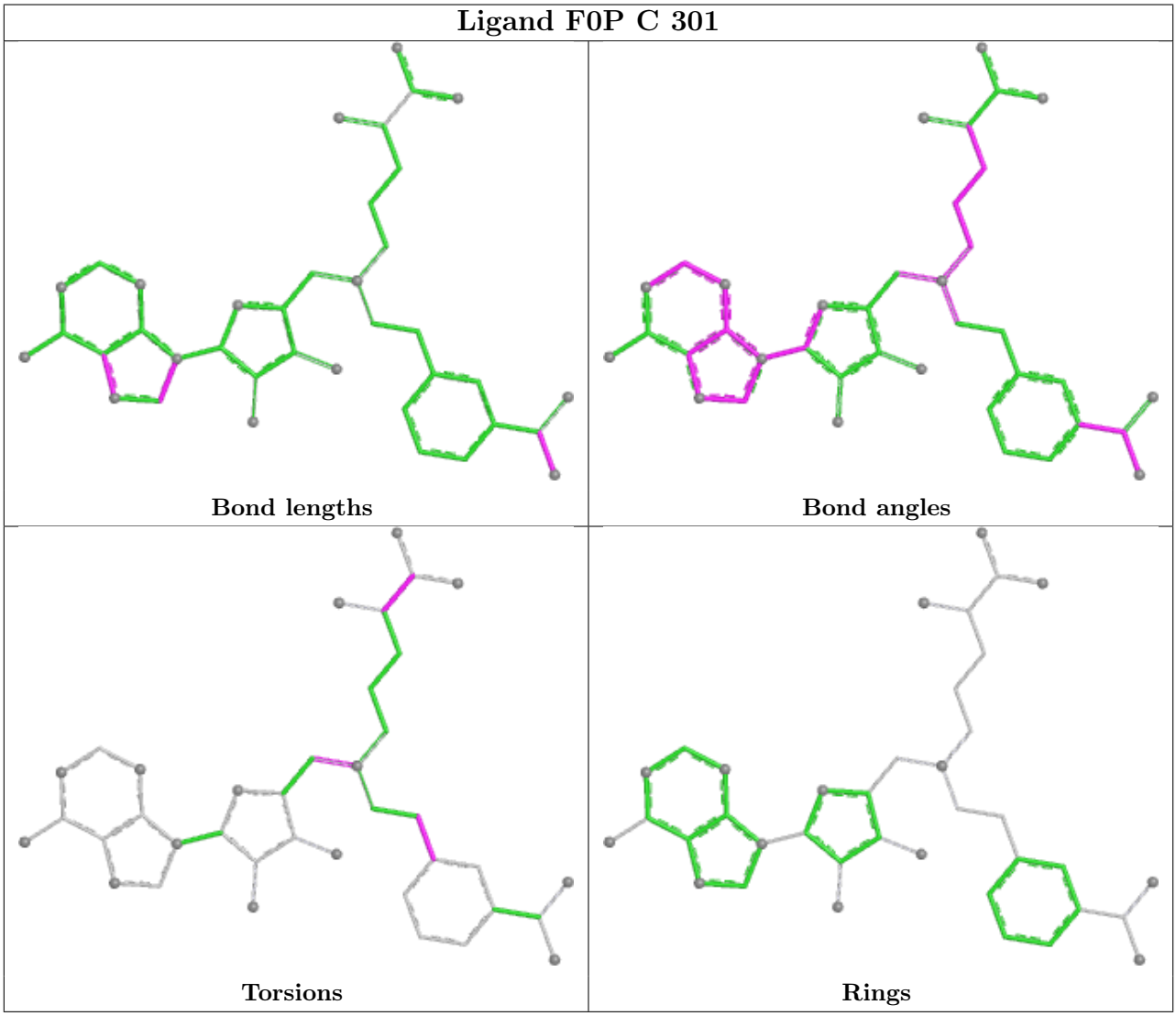
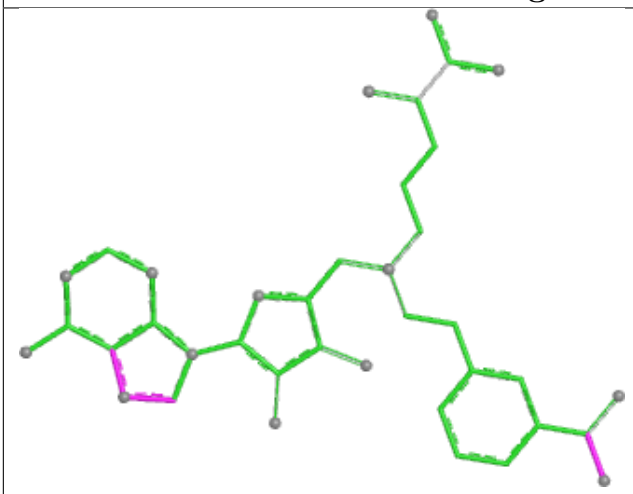
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	301	F0P	1	0
3	B	302	EDO	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

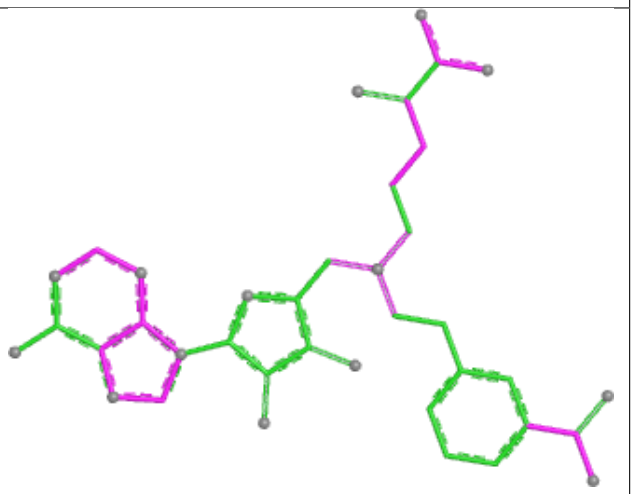
Ligand F0P C 301



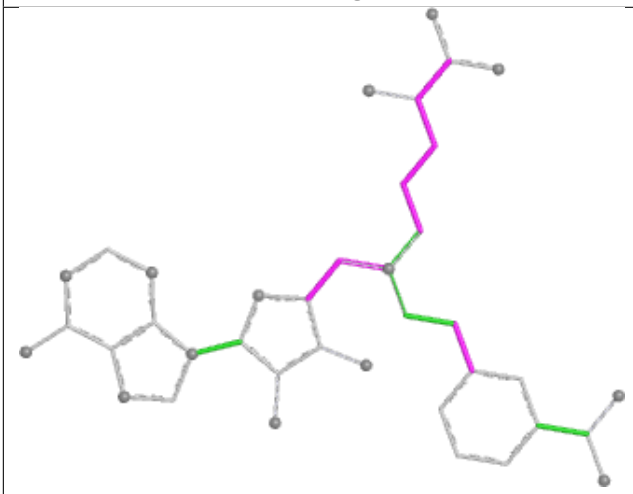
Ligand F0P A 301



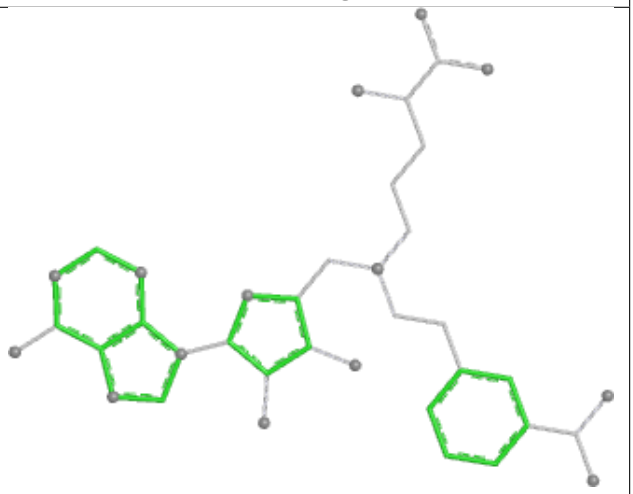
Bond lengths



Bond angles

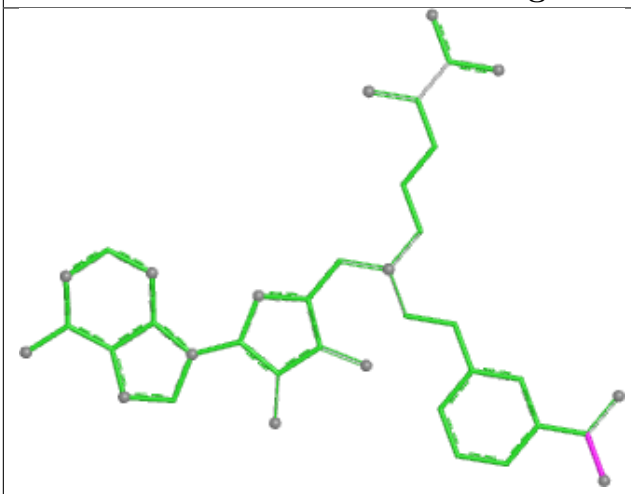


Torsions

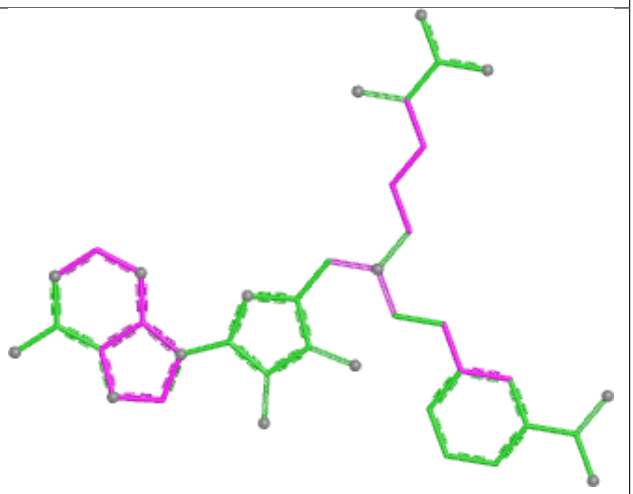


Rings

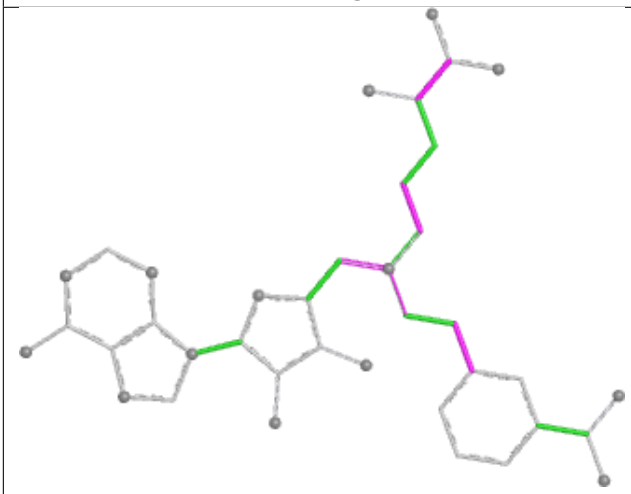
Ligand F0P D 301



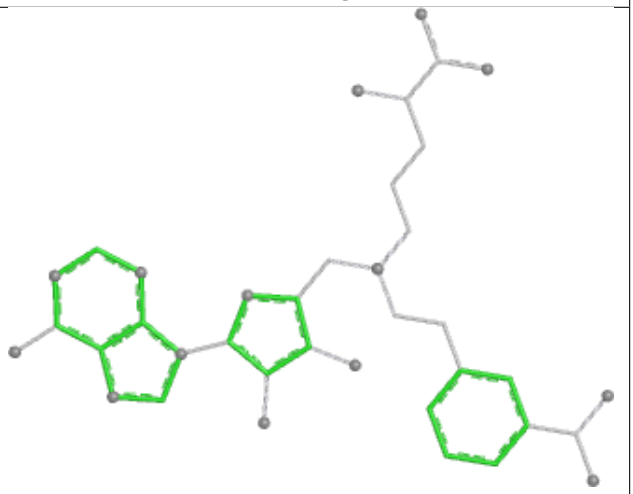
Bond lengths



Bond angles

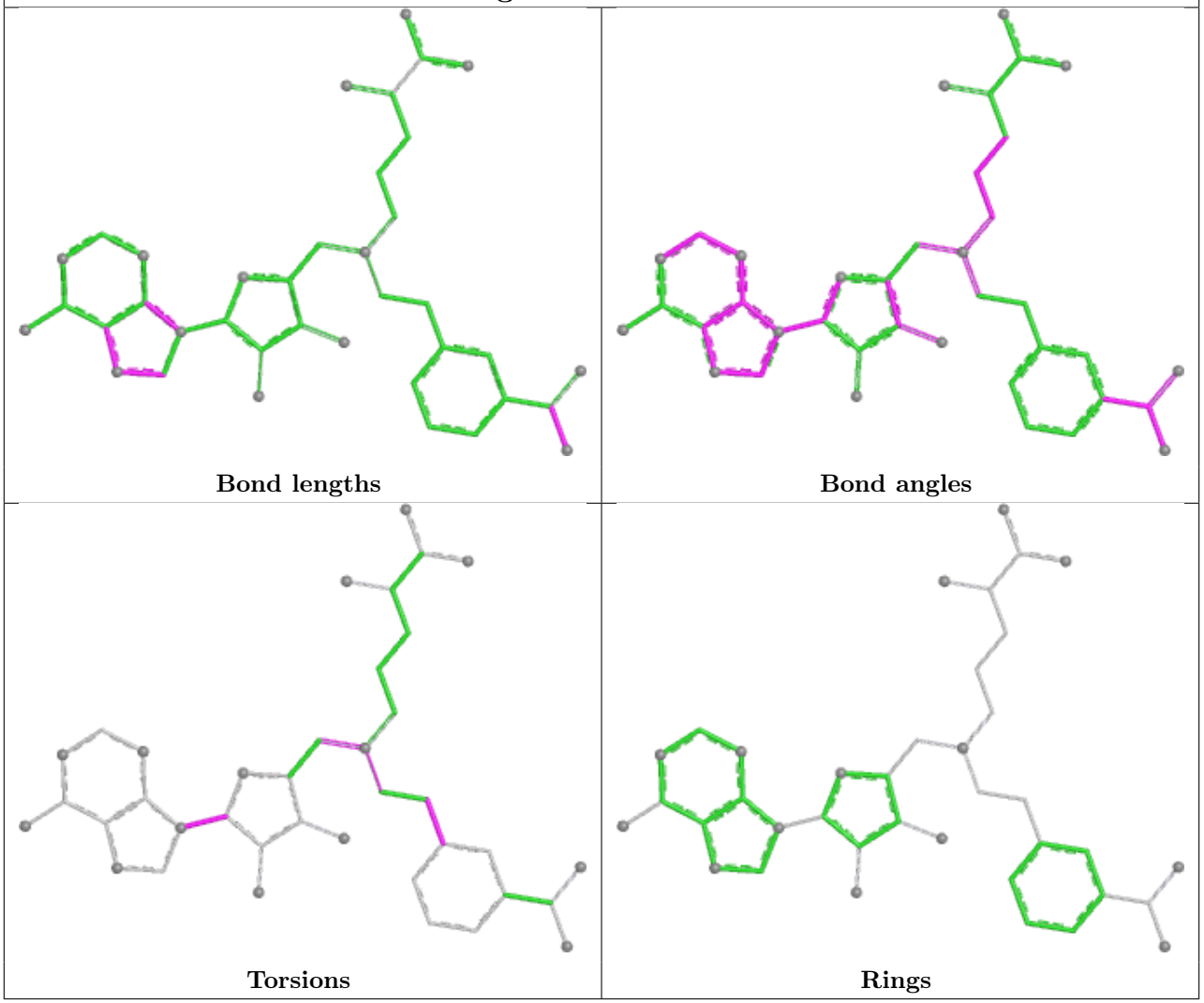


Torsions



Rings

Ligand F0P B 303



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	269/283 (95%)	-0.10	8 (2%)	52	54	10, 22, 46, 84	0
1	B	267/283 (94%)	-0.15	6 (2%)	62	64	12, 23, 45, 67	0
1	C	244/283 (86%)	0.05	6 (2%)	58	60	13, 28, 56, 107	0
1	D	243/283 (85%)	-0.01	7 (2%)	53	56	12, 27, 55, 95	0
All	All	1023/1132 (90%)	-0.05	27 (2%)	57	59	10, 25, 51, 107	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	28	GLY	4.5
1	A	-7	SER	3.9
1	D	31	HIS	3.9
1	A	261	SER	3.6
1	B	-7	SER	3.3
1	A	30	ARG	3.2
1	D	53	GLY	3.2
1	D	30	ARG	3.1
1	B	53	GLY	3.1
1	A	29	SER	3.0
1	B	262	ARG	3.0
1	D	234	TRP	3.0
1	C	122	VAL	2.9
1	D	40	HIS	2.9
1	C	27	PHE	2.9
1	A	262	ARG	2.9
1	B	234	TRP	2.8
1	A	31	HIS	2.7
1	D	52	ASP	2.7
1	B	26	LYS	2.4
1	C	121	ARG	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	31	HIS	2.3
1	D	119	GLY	2.3
1	B	-8	SER	2.3
1	C	151	ALA	2.2
1	A	53	GLY	2.2
1	A	-8	SER	2.1

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

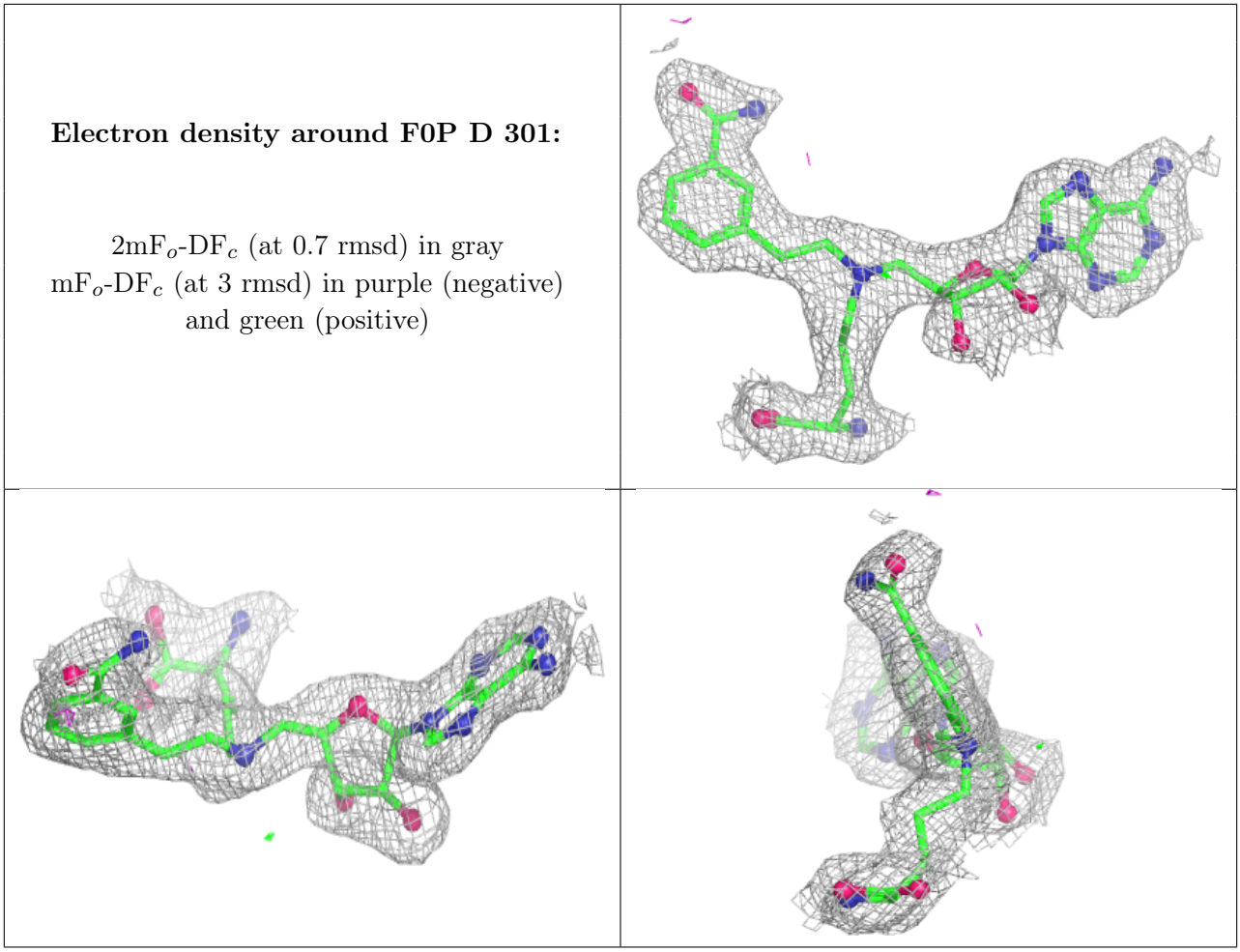
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	EDO	B	301	4/4	0.90	0.09	36,36,37,37	0
3	EDO	B	302	4/4	0.90	0.15	36,41,41,42	0
2	F0P	D	301	38/38	0.95	0.07	10,21,28,28	0
2	F0P	A	301	38/38	0.96	0.07	5,15,26,26	0
2	F0P	B	303	38/38	0.96	0.06	5,18,34,38	0
2	F0P	C	301	38/38	0.96	0.07	11,24,29,31	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

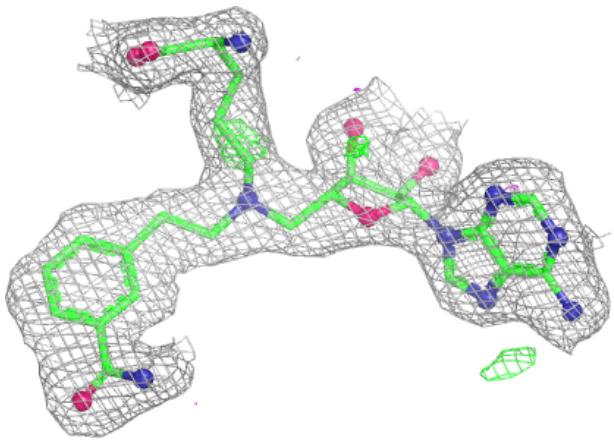
Electron density around F0P D 301:

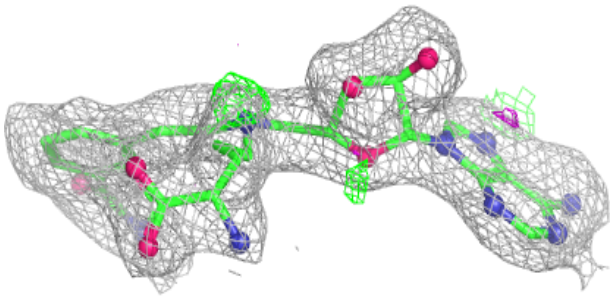
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

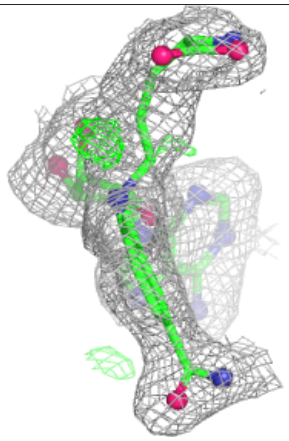


Electron density around F0P A 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

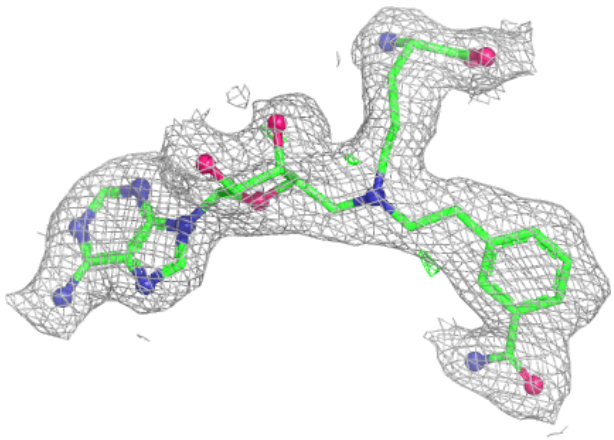


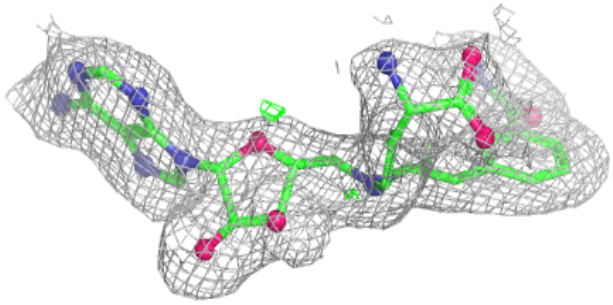


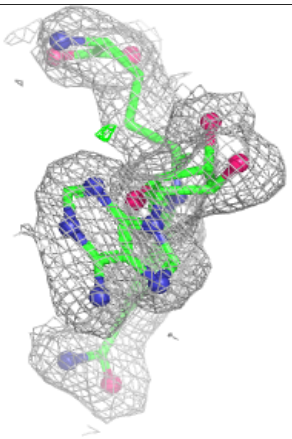


Electron density around F0P B 303:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

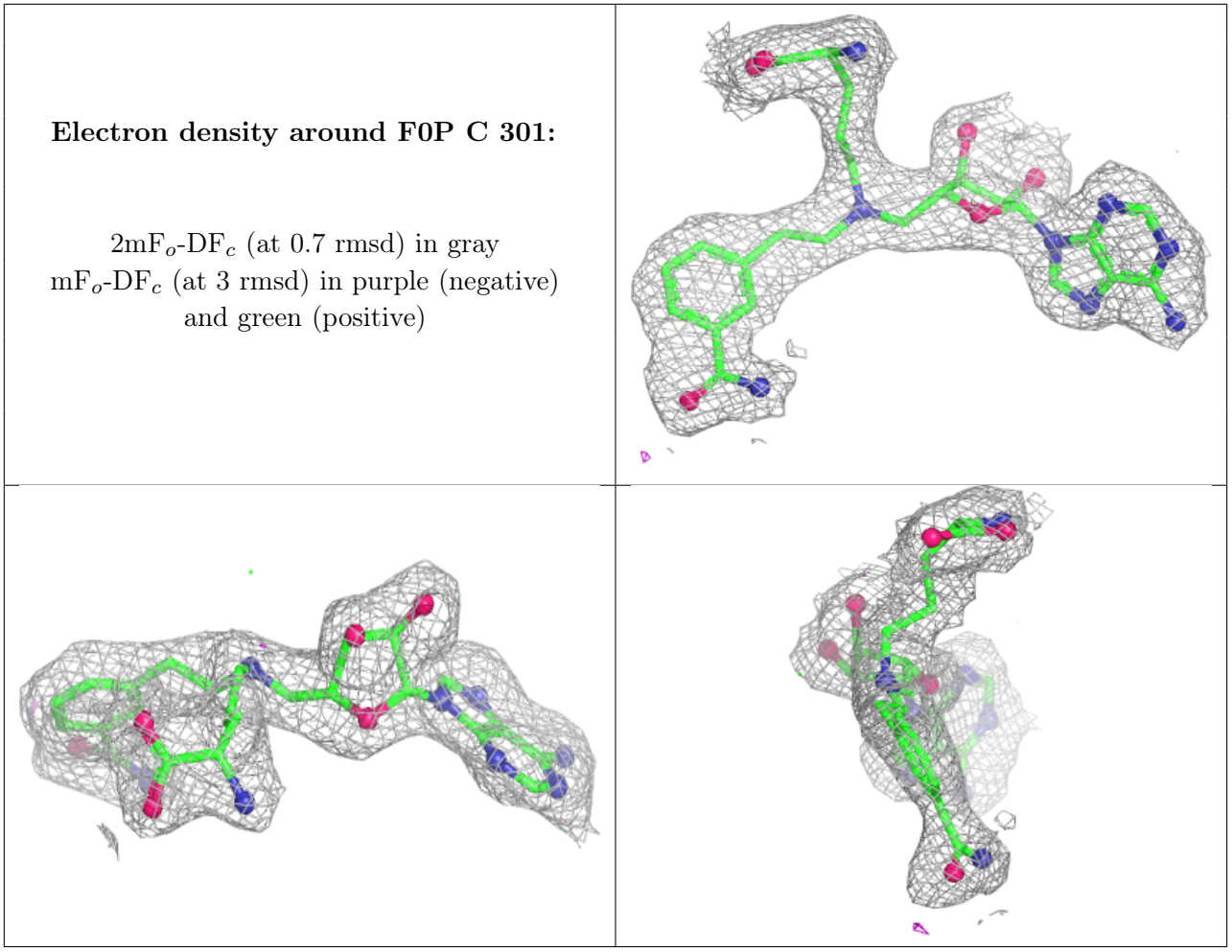






Electron density around F0P C 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers

There are no such residues in this entry.